PROCEEDINGS —

Twenty-third Annual Meeting

Volume XXIII • Number 1 1982

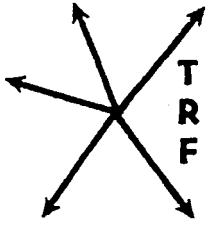
TRANSPORTATION RESEARCH FORUM

PROCEEDINGS —
Twenty-third Annual Meeting

Theme:
"Developing Concinnity in Transportation"

October 28-30, 1982
Fairmont Hotel
New Orleans, LA

Volume XXIII • Number 1 1982



TRANSPORTATION RESEARCH FORUM

STUDENT PAPER

The Domestic 30 to 60 Seat Commuter Aircraft Market: A Supply and Demand Analysis

*by James Hunsaker**

THE AIRLINE Deregulation Act of 1978 (ADA) effectively increased the role of commuter air carriers in the U.S. air transportation system. Commuter operators have replaced larger carriers in markets which are too small to be profitably served by jet aircraft. Among the provisions of the ADA which were designed to help commuter carriers with their enlarged responsibilities was an amendment to the Federal Aviation Act of 1958 which increased the capacity limit for commuter aircraft from 30 to 55 seats. In accordance with the Act, the Civil Aeronautics Board (CAB) subsequently raised the limit further to 60 seats.

This study compares the demand for aircraft in the 30 to 60 seat class with manufacturers' supply intentions for the time period from 1982 through 1990. The domestic market is the focus of this comparison since only the United States previously restricted the use of aircraft in this size category.

Commuter airline development before and after deregulation is presented in the first section of this report. Next, market demand is evaluated by: identifying the characteristics of city-pairs which are suitable for 30 to 60 seat aircraft, listing factors which will impact demand in the future, and estimating demand from Federal Aviation Administration (FAA) forecasts and current industry projections. The third section analyzes market supply by first discussing important design objectives for new aircraft in this class. Each existing or planned aircraft in the market is then described, followed by an estimate of total aircraft supply derived from manufacturers' future production plans and sales forecasts. Finally, the demand and supply estimates are compared and the implications of imbalances for manufacturers and carriers are discussed.

COMMUTER AIRLINE INDUSTRY DEVELOPMENT

**University of Texas, Graduate School of Business.*

Commuter Airlines Prior to Deregulation

One of the first regulations passed by the newly-created Civil Aeronautics Administration (later, the CAB) in 1938 exempted non-scheduled operators from the economic and safety regulations of the Civil Aeronautics Act. It allowed the establishment of small, irregular air carriers but at the same time, limited the capacities of aircraft used in such operations to ten passengers. In 1952, Part 298 of the Economic Regulations was enacted allowing these carriers to begin scheduled air service to small communities.

Throughout the 1950s, commuter airlines were a negligible part of the nation's air transportation system. Between 1952 and 1963, the number of commuter operators never exceeded twenty.[1]

By 1968, however, over 200 commuter airlines carrying almost three million passengers served the U.S. Three main factors caused this growth. First, advancements in engine and airframe technology created economic incentives for commuter operators to serve short-haul routes. Second, the emergence of medium-size jets such as the Boeing 727 and Douglas DC-9 caused local service carriers to become less local, decreasing service levels to many small markets. Third, the CAB's adoption of the suspension substitution rule in 1964 allowed commuters to assume the service obligations of larger airlines in certain low-volume markets.

Steady growth continued through 1978 as the industry experienced improved profitability. The key to this period of growth was the dramatic increase in fuel costs which made commuter travel more cost-competitive with automobile travel.

The Effect of Deregulation on Commuter Air Carriers

From the commuter operator's point of view, the Essential Service Program

is the cornerstone of the ADA. In response to fears that low-volume markets would be abandoned by trunk and local service carriers in a deregulated environment, Congress included provisions in the ADA to ensure that small communities would retain some form of air service. Two aspects of this program encouraged commuters to provide small community service. First, a carrier was restricted from abandoning a community where it was the sole provider of air service until a replacement (usually a commuter airline) was found. Second, commuters became eligible for subsidies to support service to unprofitable communities.

Commuters have fulfilled their duties to provide essential service. Through 1980, commuter carriers served 240 of the 319 essential air service points outside of Alaska. Of these, 187 were served exclusively by commuters.[2]

In addition to raising aircraft capacity limits, the ADA supported commuter operators by making joint fares between commuter airlines and larger carriers mandatory. The CAB has enforced this change by requiring joint fares on all coach tickets between cities where single carrier service is not available. This ruling does not apply to discount-rate tickets.

One final provision of the ADA designed to help commuter operators made them eligible for the FAA Equipment Loan Guarantee Program. Such guarantees allow commuter carriers to qualify for lower interest rates on new aircraft loans.[3]

The commuter airline industry experienced an annual growth in passenger enplanements of 20.0 percent in 1978 and 26.7 percent in 1979. Even in 1980, when traffic levels fell for large carriers, commuter passenger traffic increased 16.0 percent over the previous year.

The full force of the nation's economic ills was felt by commuters in 1981 as traffic levels declined. Two other factors contributed to this trend. The use of discount fares by passengers on major and national carriers rose from 50 to 70 percent, thereby decreasing the number of passengers eligible for joint fares. Traffic was depressed further by the air traffic controller's strike. Computer operators serving large hub airports were forced to cut back flights by as much as 50 percent when the strike went into effect.

Commuter officials still see a rosy future for their industry. Alan Stephen, vice-president operations of the Regional Airline Association, notes that, "Nothing has changed the basic economics of deregulation—jet aircraft are still basically uneconomical on short hauls and commuter-type aircraft remain 40 percent more fuel-efficient than automobiles."[4]

DOMESTIC DEMAND FOR 30 TO 60 SEAT COMMUTER AIRCRAFT

Appropriate City-Pairs for 30 to 60 Seat Aircraft

The level of passenger traffic required for profitable service between two points depends primarily on three factors: the size of aircraft used to serve the route, the break-even load factor associated with the aircraft, and the frequency of service offered. In most cases at least 40 daily passengers in one direction are required in order for the use of a 30 passenger or larger aircraft to be economical on a given route.

Current utilization of 30 to 60 seat aircraft by commuters can be analyzed from a survey of Official Airline Guide (OAG) flight entries. The results of this survey are shown in Table 1. Its objective was to identify general trends among the city-pairs where aircraft of this size are currently being used. To simplify locating entries in the OAG, only carriers with large 30 to 60 passenger fleets were considered. The data collected for each city-pair included: the type of aircraft used, the hub classifications of both cities and the stage length of the flight.

Survey results show that large hubs are served on almost 90 percent of the flights. Large hub-nonhub flights are the most common at 42 percent, followed by large hub-small hub flights at 29 percent. Surprisingly, commuters are also serving routes connecting two large hubs. Ten percent of the flights surveyed were on such routes.

Future Issues Which Will Impact Demand

Five key factors will affect commuter aircraft demand in the 1980s. Changes in fuel costs will: alter the cost-competitiveness of commuter travel relative to automobile travel, change the minimum stage lengths on which jets are economical to operate, and adjust the value of the improved fuel-efficiencies in new-generation aircraft.

Adequate capital must be both available and affordable if fleet modernization is to occur. Continued high interest rates will force carriers to purchase more used aircraft or to re-engine current aircraft. Two facts explain why commuter aircraft demand is more sensitive to interest rates than demand for equipment in many other industries. Many

TABLE 1

OFFICIAL AIRLINE GUIDE SURVEY RESULTS

Hub Classifications	30 TO 44 SEAT AIRCRAFT Observations	Percent of Total	45 TO 60 SEAT AIRCRAFT Observations	Percent of Total	ALL Percent of Total
Large Hub — Large Hub	1	2	9	16	10
Large Hub — Medium Hub	3	7	3	5	6
Large Hub — Small Hub	13	30	16	29	29
Large Hub — Nonhub	19	43	23	41	42
Medium Hub — Medium Hub	0	0	0	0	0
Medium Hub — Small Hub	1	2	1	2	2
Medium Hub — Nonhub	1	2	2	4	3
Small Hub — Small Hub	1	2	1	2	2
Small Hub — Nonhub	5	11	1	2	6
Nonhub — Nonhub	0	0	0	0	0

Note: The FAA classifies hub airports according to the percent of total U.S. enplaned passengers. Large — 1.00 or more; Medium — 0.25 to 0.99; Small — 0.05 to 0.24.

commuter carriers are poorly financed and highly dependent on revenue flows to keep loan payments current. Also, the larger aircraft some commuters will be purchasing will cost up to five times as much as the smaller aircraft they are replacing.

Major shifts in the types of markets served by commuters will also affect demand. One of the more common predictions is that short-haul, "shuttle" flights between two large hubs or one large and one medium hub will make up the largest portion of commuter flights in the future.[5] Increasing this type of service would shift demand toward larger commuter aircraft.

Demand for aircraft will also be a function of the degree of cooperation between commuter airlines and major or national airlines. Continuation of the mandatory joint fare program beyond its scheduled termination date of 1983, or ensuring a negotiation system in which commuters can bargain effectively will stimulate demand levels.

Finally, continued access to large hub airports is also key to future aircraft demand. Crowded conditions at several U.S. airports has created the need to allocate takeoff and landing slots. Any allocation system which effectively excludes commuters (such as bidding for slots) will cause a drop in commuter traffic and aircraft demand.

Demand Estimation Methodology

The 30 to 60 seat commuter aircraft market can be divided into two segments, 30 to 44 seats and 45 to 60 seats. Most of the aircraft on the market are clustered in the 30 to 36 passenger range or the 46 to 52 passenger range.

Many market studies predicting the total demand for 30 to 44 seat aircraft have been conducted since deregulation. The results differ not only in terms of final estimates but also in time periods of study and categorizations of aircraft. In the 45 to 60 seat class, demand estimates are fewer in number and less dynamic.

The first step in determining appropriate demand estimates for each category is to consider the results of The 1979 FAA Light Transport Market Survey. Because aircraft and engine manufacturers around the world maintain extensive market forecast capabilities and employ comprehensive forecast techniques, the FAA chose to employ a consensus approach for their market estimate.[6] Sources for the study included twelve U.S. and foreign aircraft manufacturers, three U.S. and foreign engine manufacturers, two forecasts developed by independent consultants, two composite forecasts developed by trade associations and a previous FAA study. All of the forecasts surveyed had been up-

dated at the time of the study and took into account the projected impacts of deregulation, commuter traffic growth, aircraft replacement trends and overall economic growth.

Since the FAA could not evaluate the relative comprehensiveness of each forecast, all predictions were weighted equally. Some forecasts predicted world demand, some predicted domestic demand and some predicted both. From those that predicted both, a U.S. market share was estimated. Time periods of study also varied among forecasts. To remove this effect from the data, each forecast was annualized, then extrapolated forward to the time periods 1980 to 2000 and 1980 to 1990.

The FAA survey categorizes light transport aircraft in three groups: 15 to 19 passengers, 20 to 40 passengers and 41 to 60 passengers. Because aircraft in the 20 to 29 passenger class are either out of production or are oriented toward military use, and because no aircraft exist in the 41 to 44 passenger range, the two larger survey categories of the FAA correspond to the 30 to 44 seat and 45 to 60 seat categories used in this analysis.

Results from the FAA survey stated in the 1980 to 1990 time period can be adjusted on an annualized basis to reflect the time period from 1982 through 1990. The demand estimates derived in this manner are: 387 aircraft in the U.S. for the 30 to 44 seat market, with the U.S. share of the world market estimated to be 45 percent; and 176 aircraft in the U.S. for the 45 to 60 seat market, with the U.S. share of the world market estimated to be 35 percent.

Since the 45 to 60 seat market is more stable than is the 30 to 44 seat market, results from the 1979 FAA study are satisfactory. To incorporate changes which may have occurred since 1979 into the 30 to 44 seat demand figure, a survey of 1981 manufacturers' estimates is used. The estimates are taken from current literature and are summarized in Table 2. All of the estimates were originally expressed in terms of the world market. They have been converted into domestic estimates by using the U.S. market share forecasts of the FAA study.

A 1981 consensus demand figure is arrived at by averaging the estimates of all manufacturers. Because of the larger size and greater degree of sophistication of the FAA survey, its estimate, although less current than the 1981 estimate, will be averaged with the 1981 forecast to arrive at a final 30 to 44 seat demand estimate.

The final demand projections are summarized in Table 3. For the 30 to 44 seat aircraft market, demand is estimated to be 397 aircraft through 1990. A forecast of 176 aircraft in the 45 to 60 seat class is also calculated.

DOMESTIC SUPPLY OF 30 TO 60 SEAT COMMUTER AIRCRAFT

Design Objectives in New Commuter Aircraft

The key design objectives in new commuter aircraft can be divided into three general groups: passenger comfort, economic efficiency, and aircraft performance.

If commuter airlines are to be readily accepted by the travelling public, the aircraft they fly must provide comfort characteristics similar to those of large jet aircraft. One major question confronting manufacturers is whether to design a pressurized or an unpressurized aircraft. To commuter operators, pressurization increases the purchase price of an aircraft by one-third.[7] In addition to the passenger comfort benefits

TABLE 2

SUMMARY OF 1981 MANUFACTURERS' 30 TO 44 SEAT AIRCRAFT DEMAND FORECASTS

Manufacturer	Adjusted World Demand Forecast, 1982-1990
Aerospatiale	400
CASA	1050
DeHavilland	800
Embraer	1500
General Electric	900
SAAB/Fairchild	800
Short Brothers	900
World Average =	907
U.S. Average (45% of World) =	408

TABLE 3

FINAL DEMAND FORECAST

Aircraft Class	U.S. Market Demand, 1982-1990
30 to 44 Seats	397
45 to 60 Seats	176

of pressurization, an aircraft so equipped can fly at high altitudes increasing the fuel efficiency of its turboprop engines. Other amenities which commuter passengers will desire include: lavatories, carry-on baggage space, stand-up headroom, and increased legroom.

To offset their high acquisition costs of approximately $100,000 per seat, new-generation commuter aircraft will feature substantial savings in operating costs. The use of turboprops to power these aircraft is one source of savings. Most new aircraft in the 30 passenger range will have fuel consumption rates of 31 passenger-miles per gallon. This compares favorably to the 21 passenger-mile per gallon rates common to DC-9s and 737s.[8]

One aircraft performance requirement of new-technology aircraft is increased range over current aircraft. The new equipment must permit multiple stops without the need to refuel. To be competitive with jets on routes of up to 250 miles, new commuter aircraft will need cruise speeds of at least 250 miles per hour. Decreased takeoff and landing field requirements are also needed. This will enable aircraft to use short general aviation runways or blocked off segments of commercial runways. The use of such aircraft will free up longer runways for jet operators.

30 to 44 Seat Aircraft

Most aircraft manufacturers did not foresee the rapid growth in both the amount of commuter traffic and the size of markets served by commuters. The few that did, waited until the pattern of commuter market growth had solidified before making a final decision to produce a new-generation aircraft. As a result of this uncertainty, commuters carriers will have to wait until 1984 for new-technology 30 to 44 seat aircraft.

Three types of 30 to 44 seat aircraft can be identified. The first category, derivative aircraft, is made up of only market enty, the Gulfstream G1-C. Two Shorts Brothers aircraft, the SD-330 and the SD-360 comprise the current technology category. New-technology is the third category and four aircraft of this type are being developed, they are: the Embraer EMB-120, the DeHavilland Dash 8, the SAAB/Fairchild SF-340 and the CASA/Nurtanio CN-235. These aircraft are compared in Table 4.

45 to 60 Seat Aircraft

The high end of the commuter aircraft market, 45 to 60 passengers, is not predicted to experience the large growth rates of the 30 to 44 seat market. Nevertheless, the market will see significant growth, especially when some of the aging planes currently being used require replacement. In fact, some commuter operators are currently in such need of large commuter planes that they are flying DC-3s and Convair 580s. These aircraft are costly to operate.

Only one new-technology 45 to 60 seat aircraft is planned for the 1980s. It is

TABLE 4

30 TO 44 SEAT AIRCRAFT DESCRIPTIONS

Aircraft	Passenger Capacity	Initial Delivery	Operating Cost Level	1981 Price Estimate	Manufacturer's Nationalities	Notes
G1-C	37	1981	High	$3,600,000	United States	Stretched business aircraft
SD-330	30	1976	Moderate	3,000,000	Northern Ireland	Unpressurized
SD-360	36	1983	Moderate	3,700,000	Northern Ireland	Stretch of the SD-330
EMB-120	30	1985	Low	3,200,000	Brazil	Low interest financing
Dash 8	36	1984	Low	3,900,000	Canada	Short field requirements
SF-340	34	1984	Low	3,800,000	United States, Sweden	Long range, high cruise altitude
CN-235	36	1985	Low	3,800,000	Spain, Indonesia	Military use also

the Aerospatiale/Aeritalia ATR 42. Two aircraft, first built more than 20 years ago, are expected to remain popular for many years to come. These are the Fokker F27 and the British Aerospace 748. Two current technology aircraft, the DeHavilland Dash 7 and the Commuter Aircraft CAC-100, will also be available to carriers in the future. Table 5 details the basic characteristics of each of these aircraft.

Supply Estimates— 1982 Through 1990

To calculate the total domestic aircraft supply, the proportion of each aircraft's sales targeted for the U.S. must be determined. In some cases, manufacturers have publicly declared this figure while in other instances, the proportion is estimated by taking into consideration the nationalities of the manufacturer(s) and the domestic sales proportions of similar aircraft. Next, the total production of each aircraft through 1990 is estimated. This is done either by using manufacturer's production schedules or their sales projections. Multiplying these two values yields the U.S. supply for each plane. Final supply estimates are shown in Table 6.

It is important to note that these figures represent current manufacturers' expectations. The actual production levels will certainly be changed by market forces in the future. In addition, new programs may be initiated or current programs may be halted.

In the 30 to 44 seat category, a supply of 927 aircraft is predicted. Five models show relatively similar supply figures while the CN-235 and G1-C values become progressively smaller. All but two manufacturers plan on selling at least half of their aircraft to U.S. commuter operators.

A smaller supply level of 508 aircraft is predicted for the 45 to 60 seat category. The Dash 7 is predicted to lead the category in number of aircraft produced for U.S. commuters. All four of the foreign aircraft programs are expected to sell 50 percent of their total sales to domestic operators.

CONCLUSIONS

Supply and Demand Comparison

Figure 1 compares the supply and demand forecasts for both aircraft categories. In both cases the projected supply is at least twice as large as the projected demand. Clearly, the U.S. market potential for both sizes of aircraft is large, but not when divided among seven (in the 30/44 class) or five (in the 45/60 class) market entrants. Predictably, marketing officials of each manufacturer claim to have the key advantage over the competition which will enable their aircraft to reach its U.S. sales goal. The 30 to 44 passenger market is particularly critical to manufacturers since six of the seven market entrants represent recent (since 1976) development programs.

Implications of Oversupply for Manufacturers

Although most manufacturers claim that the break-even sales level for their aircraft is 200 units, an estimate of 350 units is more realistic when aircraft development costs of between $80 and $130

TABLE 5

45 TO 60 SEAT AIRCRAFT DESCRIPTIONS

Aircraft	Passenger Capacity	Initial Delivery	Operating Cost Level	1981 Price Estimate	Manufacturer's Nationalities	Notes
F27	52	1956	High	$5,700,000	Netherlands	Largest selling turboprop
BAe 748	48	1964	High	6,000,000	Great Britain	Must be modified for U.S. use
Dash 7	50	1976	Moderate	6,200,000	Canada	Only true STOL aircraft
ATR 42	46	1985	Low	5,000,000	France, Italy	Only new technology aircraft
CAC-100	50	1985	Moderate	4,000,000	United States	Revival of 20 year old design

TABLE 6

DOMESTIC SUPPLY SUMMARY

Aircraft	Estimated Total Production	Production Estimation Method	Proportion of Sales to U.S.	Proportion Estimation Method	Total U.S. Supply
30 to 44 Seat Market:					
G-1C	36	PC	1.00	EP	36
SD-330	324	PL	0.50	DP	162
SD-360	317	PS	0.60	DP	187
EMB-120	300	PS	0.50	CP	150
Dash 8	392	PS	0.40	DP	158
SF-340	432	PS	0.33	DP	144
CN-235	180	PS	0.50	PO	90
					927
45 to 60 Seat Market:					
F27	144	PL	0.50	EP	72
BAe 748	72	PL	0.50	EP	36
Dash 7	324	PL	0.50	DP	162
ATR 42	216	PL	0.50	DP	108
CAC-100	216	PL	0.60	EP	130
					508

Estimation Methods:

PL — Production levels scheduled by manufacturer
PC — Production of comparable aircraft and manufacturer
PS — Predicted sales level by manufacturer
DP — Domestic proportion goal of manufacturer
EP — Estimated U.S. proportion of sales of similar aircraft
CP — Current U.S. proportion of all options
PO — Proportion of sales in U.S. of other aircraft produced by the same manufacturer

million are fully considered.[9] Assuming that the U.S. accounts for 45 and 35 percent of the 30/44 and 45/60 class world sales respectively, and that one-half of the aircraft sales will occur before 1991, break-even levels for U.S. sales can be estimated at 79 units in the 30/44 class and 56 units in the 45/60 class.

From the 30 to 44 seat aircraft demand estimate, the highest number of manufacturers which could just break-even is five, when previous sales are not included. Since the chances of five aircraft having nearly identical market shares are small, an estimate of two manufacturers not breaking even is very conservative. More likely estimates are three or four money losing programs.

In the 45 to 60 seat category, two programs, the BAe 748 and the F27, have long since passed the break-even sales level. The Dash 7 has had sales of over 100 in its brief history. With an estimated class demand of 176, it is possible that the two new aircraft, the ATR 42 and the CAC-100, could both break-even, but this is contingent on limited additional sales of the three older models. Assuming the Dash 7 sales orders remain strong, it is likely that one of the two new programs will not be profitable.

Three basic options are open to manufacturers which perceive that their aircraft programs will not be profitable in

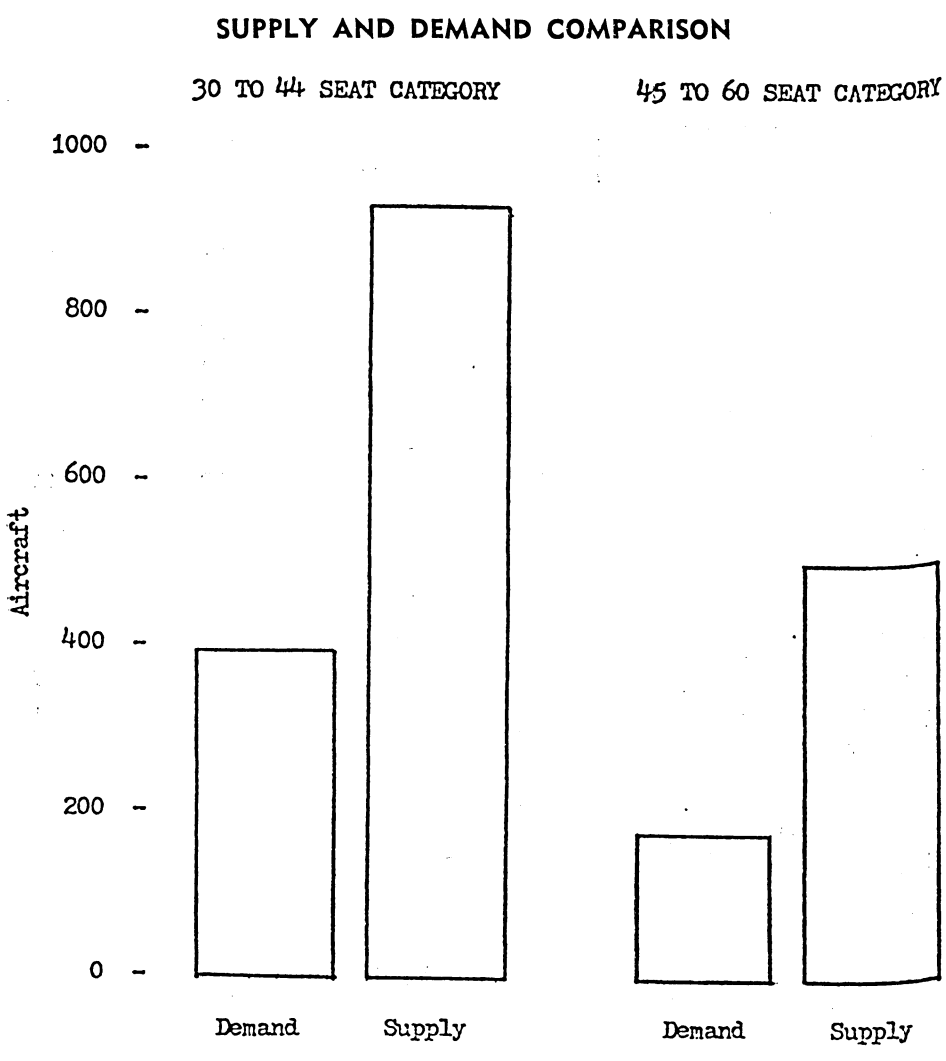


FIGURE 1

the U.S. market. First, the manufacturer can redistribute target market shares away from the U.S., focusing more on sales in the rest of the world. This is less practical for North American manufacturers than it is for other manufacturers. Another option is to orient the aircraft more toward non-airline use. Both military and corporate demand could help sustain a program in the future. Finally, the aircraft program can be completely halted, thereby limiting losses to those already incurred development and tooling up costs.

Implications of Oversupply for Carriers

The nation's commuter carriers will be the primary beneficiaries of this aircraft surplus. Operators will have a wide selection of aircraft from which to choose. Competition will force manufacturers to keep aircraft acquisition costs down and will also cause an improvement in aircraft support programs over current programs. In short, the period from 1982 through 1990 will be a buyer's market for 30 to 60 seat commuter aircraft.

FOOTNOTES

1 Jonathan D. Mayer, "Local and Commuter Airlines in the United States," **Traffic Quarterly,** April, 1977, p. 343.

2 U.S. Congress, Senate Committee on Commerce, Science and Transportation, **Status of the U.S. Commuter Airline Industry,** 97th Congress, 1st session, 1981, p. 42.

3 **Ibid.,** p. 47.

4 Lou Davis, "U.S. Commuter Operations Climate Changing," **Interavia,** March, 1979, p. 253.

5 "Commuters Move Into Small Markets," **Aviation Week and Space Technology,** November 3, 1980, p. 98.

6 Federal Aviation Administration, "Light Transport Aircraft Market Forecast," Report No. ATR-79 (4857-03) 2ND, 1979, p. 2.

7 "Commuter Pressurization Rule Opposed," **Aviation Week and Space Technology,** July 16, 1979, p. 36.

8 U.S. Congress, House of Representatives, Committee on Public Works and Transportation, **Availability of Aircraft to Meet the Needs of the Commuter Airline Industry in the 1980s,** hearings before the subcommittee on aviation, 96th Congress, 2nd session, July 30, 1981, p. 7.

9 Marc Grangier, "Commuter Aircraft Supply and Demand Out of Balance," **Interavia,** August, 1981, p. 819.